

CLAIMS:

1. A formic acid fuel cell comprising:
an anode (12, 134) and a cathode (16, 135), and an electrolyte (14, 131) sandwiched between said anode and said cathode;
an oxidizer in communication with said cathode;
a formic acid fuel solution in communication with said anode;
and,
an anode catalyst comprising Pd.
2. A formic acid fuel cell as defined by claim 1 wherein said anode catalyst further includes a metal chosen from the group of metals Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, and Au.
3. A fuel cell as defined by claim 1 wherein M is Au.
4. A fuel cell as defined by claim 1 wherein M is V.
5. A fuel cell as defined by claim 1 wherein M is Mo.
6. A fuel cell as defined by claim 1 wherein said anode catalyst comprising Pd is supported on carbon.
7. A fuel cell as defined by claim 6 wherein said Pd comprises nanoparticles supported on said carbon.
8. A fuel cell as defined by claim 7 wherein said Pd nanoparticles are no greater than about 10 nm.
9. A fuel cell as defined by claim 7 wherein said Pd nanoparticles are no greater than about 5 nm.

10. A fuel cell as defined by claim 6 wherein said anode catalyst is prepared by a metal chloride reduction process.

11. A fuel cell as defined by claim 6 wherein said Pd comprises at least about 5% (wt) of said catalyst based on the total weight of said catalyst.

12. A fuel cell as defined by claim 6 wherein said Pd comprises at least about 10% (wt) of said catalyst based on the total weight of said catalyst.

13. A fuel cell as defined by claim 6 wherein said Pd comprises at least about 20% (wt) of said catalyst based on the total weight of said catalyst.

14. A fuel cell as defined by claim 6 wherein said anode catalyst has a Pd dispersion of at least about 20%.

15. A fuel cell as defined by claim 6 wherein said anode catalyst has a Pd dispersion of at least about 50%.

16. A fuel cell as defined by claim 1 wherein said anode catalyst comprises Pd and Au supported on carbon.

17. A fuel cell as defined by claim 1 wherein said formic acid fuel solution contains at least about 10% (wt) formic acid.

18. A fuel cell as defined by claim 1 wherein said formic acid fuel solution contains at least about 25% (wt) formic acid.

19. A fuel cell as defined by claim 1 wherein said formic acid fuel solution contains at least about 40% (wt) formic acid.

20. A fuel cell as defined by claim 1 and further including a replaceable cartridge containing said formic acid fuel solution, said cartridge configured to be removably attached to the fuel cell whereby said formic acid fuel solution may communicate with said anode.

21. A formic acid fuel cell comprising:
an anode and a cathode, an electrolyte sandwiched between said anode and said cathode;
an oxidizer in communication with said cathode;
a formic acid fuel solution having a concentration of at least about 25% formic acid in communication with said anode; and,
an anode catalyst comprising Pd nanoparticles supported on carbon .

22. A formic acid fuel cell membrane electrode assembly comprising:
a proton-conducting membrane having opposing first and second surfaces;
a cathode catalyst on said second membrane surface; and
an anode catalyst including Pd on said first surface.

23. A formic acid fuel cell membrane electrode assembly as defined by claim 22, wherein said membrane comprises a solid polymer proton exchange membrane.

24. A formic acid fuel cell membrane electrode assembly as defined by claim 22 wherein said membrane comprises a perfluorsulfonic acid ionomer.

25. A formic acid fuel cell membrane electrode assembly as defined by claim 22 wherein said anode catalyst further includes a metal chosen from the group of metals Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, and Au.

26. A formic acid fuel cell membrane electrode assembly as defined by claim 25 wherein said anode catalyst is Au.

27. A formic acid fuel cell fuel cell membrane electrode assembly as defined by claim 22 wherein said anode catalyst comprising Pd is supported on carbon.

28. A formic acid fuel cell fuel cell membrane electrode assembly as defined by claim 22 wherein said Pd comprises nanoparticles supported on said carbon.

29. A formic acid fuel cell fuel cell membrane electrode assembly as defined by claim 28 wherein said Pd nanoparticles are no greater than about 10 nm.

30. A formic acid fuel cell fuel cell membrane electrode assembly as defined by claim 22 wherein said Pd comprises at least about 10% (wt) of said catalyst based on the total weight of said catalyst.

31. A formic acid fuel cell fuel cell membrane electrode assembly as defined by claim 22 wherein said anode catalyst comprises Pd and Au supported on carbon.

32. A formic acid fuel cell membrane electrode assembly as defined by claim 22 and further including a formic acid fuel solution of at least about 25% (wt) in communication with said anode catalyst layer.

33. A formic acid fuel cell membrane electrode assembly as defined by claim 22 and further including an electrically conductive material overlying said anode catalyst.

34. A formic acid fuel cell membrane electrode assembly as defined by claim 33 wherein said electrically conductive material comprises a metal mesh.